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NOTES ON GEOGRAPHIC DISTRIBUTION

An extension of the distribution of *Selar crumenophthalmus* (Bloch, 1793) (Teleostei: Carangidae) in southern Brazil

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ABSTRACT: In this study, we document an extension of the distribution of the Bigeye scad *Selar crumenophthalmus* to the coast of the state of Rio Grande do Sul, southern Brazil. This finding increases the range of *S. crumenophthalmus* by approximately 650 km and represents the southernmost record for the species on the western coast of the Atlantic. Additionally, as this region has been relatively well sampled both during past decades and currently, we discuss possible reasons why this range extension has been observed only recently.

The Bigeye scad *Selar crumenophthalmus* (Bloch, 1793) is a monotypic species that belongs to the family Carangidae. This species is similar to *Trachurus lathami* Nichols, 1920, *Decapterus punctatus* (Cuvier, 1829), *D. macarellus* (Cuvier, 1833), and *D. tabl* Berry, 1968. However, *S. crumenophthalmus* is easily identified because it differs from *T. lathami* primarily by the absence of scutes expanded dorsoventrally in the curved lateral line and from *Decapterus* species primarily by the absence of terminal dorsal and anal fin rays, each consisting of a strongly detached finlet (Menezes and Figueiredo 1980; Carpenter 2002).

On March 2010, a living specimen of *S. crumenophthalmus* (Figure 1) was collected in shallow waters (approximately 5 m) in a coastal area of Rio Grande do Sul, Brazil (32°10′81.8″ S, 52°05′20.7″ W – a site near the west jetty of the Patos Lagoon estuary) with a bottom trawl net. After collection, the specimen was frozen and transported to the laboratory for identification. The specimen was deposited in the Fish Collection of the Laboratório de Ictiologia, Universidade Federal do Rio Grande/FURG (FURG 2254/2010). During the collection of the sample, the surface and bottom water temperature (24.1°C and 23.8°C, respectively) and the surface and bottom salinity (11.4 and 30.4, respectively) were recorded.

Selar crumenophthalmus has a circumpolar distribution. In the western Atlantic, it occurs from Nova Scotia (Canada) to the state of São Paulo (Brazil) (Figueiredo *et al*. 2002; Menezes *et al.* 2003), but Carvalho-Filho (1999) has recorded this species from the state of Santa Catarina (Brazil). Accordingly, this report represents the first known record of *S. crumenophthalmus* on the coast of the state of Rio Grande do Sul. To our knowledge, the record of the species closest to that reported in this study is that from the municipality of Porto Belo, Santa Catarina, Brazil (approximately 27°S) (FURG 0299/1978). Therefore, the present record establishes the southernmost limit for *S. crumenophthalmus*, extending the distribution of the species by approximately 650 km (straight-line distance) relative to the previous record.

The marine and coastal ichthyofauna of southern Brazil is relatively well known. Indeed, several studies have been conducted in the region since the 70's, particularly between 1978 and 2005 (e.g., Haimovici and Moralles 1978; Haimovici *et al.* 1996; Haimovici *et al.* 2005).

FIGURE 1. *Selar crumenophthalmus* (FURG nº. 2254/2010) [120.7 mm SL] captured in shallow waters (approximately 5 m) off the southern Brazilian coast.

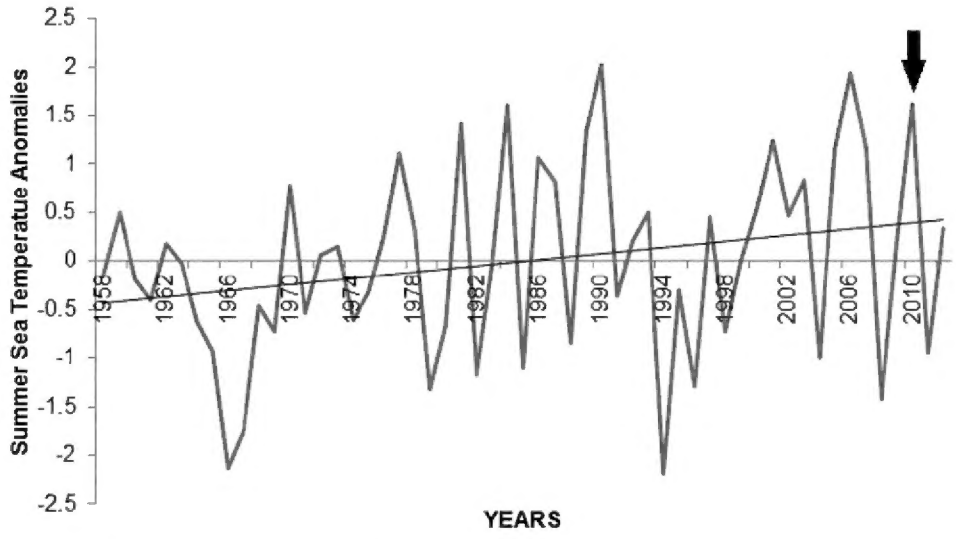

FIGURE 2. Time series (1958 to 2010) of sea surface temperature during the summer, showing the increasing temperature trend for the South Atlantic. Source: NOAA.

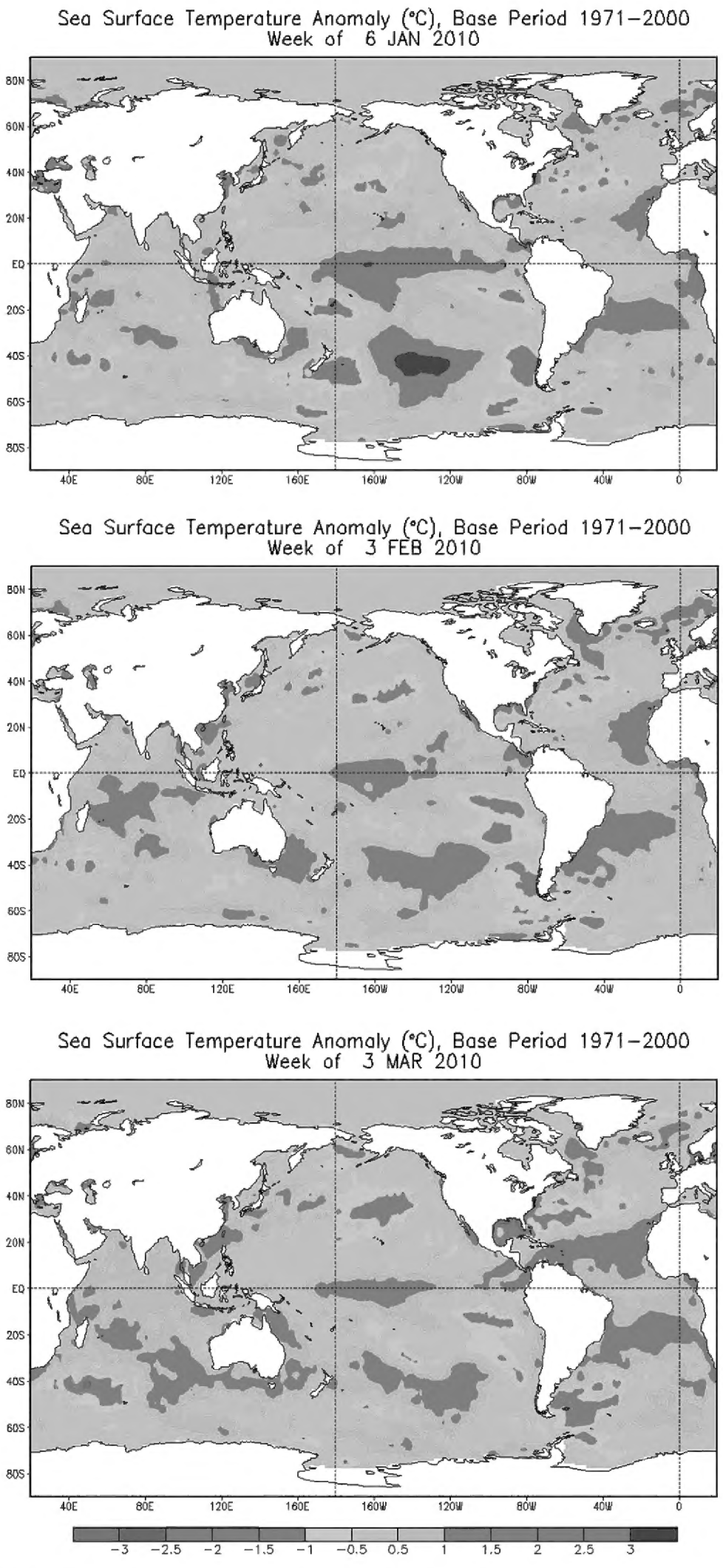

FIGURE 3. Maps of sea surface temperature anomalies for summer 2010 showing the steady increase in the surface temperature along the southern Brazilian coast. Source: NOAA.

Therefore, the absence of *S. crumenophthalmus* from the historical records, both in coastal and in deeper waters, suggests that the presence of this species in southernmost Brazil is sporadic or that the species has extended its distribution southward only recently. The coast of Rio Grande do Sul is located in the region defined by the Subtropical Convergence in the Southwest Atlantic Ocean. This feature is formed by the encounter of the warm water of the Brazil Current with the cold water of the Malvinas Current. According to Seeliger (2010), the temporal variability of the Subtropical Convergence drives the biological and ecological processes of the coastal region, at least in part. For instance, warm waters dominate the southern coast of Brazil during the spring and summer seasons (September to March) because the most intense southward displacement of the Brazil Current occurs during in this period. This displacement favors the occurrence of tropical species in subtropical and warm-temperate regions of the South Atlantic. These tropical species include *Albula nemoptera* (Fowler, 1911) and *Elops saurus* Linnaeus, 1766 (see Loebmann and Vieira 2005). Therefore, these oceanographic conditions could favor the occurrence of *S. crumenophthalmus* in extreme southern Brazil.

Additionally, historical data from 1958 to 2011 obtained from the National Oceanic and Atmospheric Administration (NOAA)/Southwest Fisheries Science Center – Environmental Research Division (http://las.pfeg.noaa.gov/las6_5/servlets/dataset?catitem=30) reveal a strong positive sea surface temperature anomaly during the summer of 2010 (Figures 2 and 3), supporting the hypothesis that an intense southward displacement of the Brazil Current could have promoted the occurrence of *S. crumenophthalmus* at southern sites (32°S).

Increases in the occurrence of warm-water species in relatively cold habitats have been recorded at several localities worldwide (e.g., Hari *et al*. 2006; Buisson *et al*. 2008; Dulvy *et al*. 2008; Ling 2008), but no publications have reported an increase in species richness induced by climate change in southern Brazil, as previously reported for the Argentinean coast (Astarloa *et al*. 2000; Delpiani *et al*. 2011). For this reason, the Brazilian government created a support program entitled SISBIOTA Brazil in 2010 with the aim of increasing the knowledge of Brazilian biodiversity and improving the ability of researchers and their cooperators to predict responses to global changes.

It is premature to relate the present record to global warming trends. However, the occurrences of tropical species appear to involve the coast of Rio Grande do Sul (e.g., Gianuca *et al*. 2008 and this study) and need to be evaluated more carefully because they may serve as indicators of a warming trend, as recently discussed by several authors (e.g., Stenevik and Sundby 2007; James *et al*. 2008). Thus, further initiatives such as SISBIOTA Brazil may help to explain the recent records of biodiversity changes along the Brazilian coast.

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NOAA *National Oceanic and Atmospheric Administration, National Climatic Data Center* Accessible at http://www.ncdc.noaa.gov/oa/climate/research/sst/weekly-sst.php. Captured on August 2012.

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